

**FRANKLINIELLA ZUCCHINI (THYSANOPTERA: THIRIPIDAE), A NEW
SPECIES AND VECTOR OF TOSPOVIRUS IN BRAZIL**

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Abstract.—*Frankliniella zucchini*, new species, is described. It is a vector of a tospovirus that causes zucchini lethal chlorotic disease of *Cucurbita pepo* L. cv. Caserta in São Paulo State, Brazil.

Key Words: *Frankliniella zucchini* n. sp., Thysanoptera, Thripidae, zucchini, vector, ZLCV, Brazil

A serious disease of zucchini squash, *Cucurbita pepo* L. cv. Caserta, currently known as zucchini lethal chlorotic disease (ZLC), was discovered during 1995 in experimental fields at Piracicaba, São Paulo State, Brazil (Rezende et al. 1997). This disease is caused by a species of *Tospovirus*, zucchini lethal chlorotic virus (ZLCV) (Pozzer et al. 1996). Tospoviruses can be transmitted only by thrips adults and larvae. The disease apparently was present sporadically in the state prior to 1991 when many zucchini plants were observed with symptoms of ZLC in Campinas county. Since then, symptoms of ZLC were observed more frequently on zucchini squash and watermelon. *Frankliniella zucchini*, new species, described here was the predominant thrips species collected from foliage and flowers of infected plants in Piracicaba. In preliminary transmission tests, this thrips was found to be a vector of ZLCV to zucchini seedlings (Rezende 1998, personal communication).

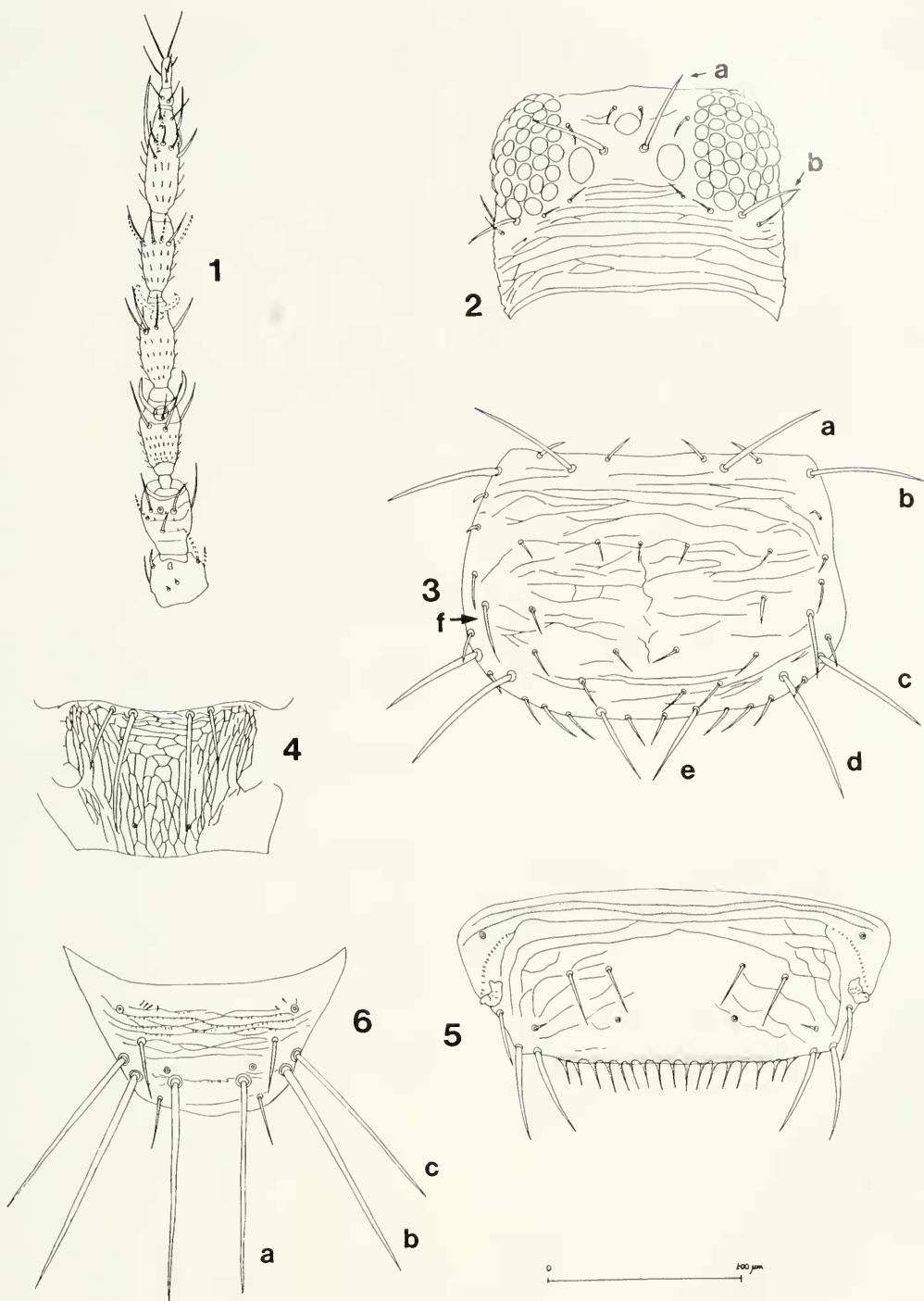
Two polyphagous *Frankliniella* species are vectors of “tomato spotted wilt virus” (TSWV) and “tomato chlorotic spot virus”

(TCSV) in Brazil (Wijkamp et al. 1995). *Frankliniella schultzei* (Trybom) dark form is an efficient vector of TSWV and TCSV that damages tomato crops. Although the yellow form of this species was previously not considered to be a vector, it is an inefficient vector of TSWV according to Wijkamp et al. (1995). The recently established *F. occidentalis* (Pergande) is a pest of various agricultural crops and also a vector. *Frankliniella zucchini* is known to vector only ZLCV and is the fifth *Frankliniella* species to be implicated in the transmission of tospoviruses. The other two are *F. fusca* (Hinds) and *F. intonsa* (Trybom).

For measurements and counts, the values for the holotype are given first and are followed by values for the paratypes in parentheses. If parentheses are absent the values are either for the holotype or for all measured specimens.

Frankliniella zucchini
Nakahara and Monteiro,
new species
(Figs. 1–6)

Female (macropterous).—Body generally yellow; forewing pale yellow, legs paler



Figs. 1–6. *Frankliniella zucchini*. Female. 1, Right antenna. 2, Head (a, ocellar seta III; b, POiv seta). 3, Pronotum (a, anteromarginal seta; b, anteroangular setae; c, outer posteroangular seta; d, inner posteroangular seta; e, posteromarginal seta II; f, submarginal seta). 4, Metanotum. 5, Abdominal tergite VIII. 6, Abdominal tergite IX (a, B1 seta; b, B2 seta; c, B3 seta). Scale = 0.1 mm.

yellow than body; body and forewing setae brown. Antennal segment I as pale as head; segment II pale yellow in proximal $\frac{1}{2}$, shaded light brown distally; segment III pale yellow in proximal $\frac{2}{3}$ including pedicel, distally brown; segment IV pale yellow in proximal $\frac{1}{2}$, brown distally and in pedicel; segment V pale yellow in proximal $\frac{1}{3}$, distally brown; segments VI to VIII brown.

Antenna (Fig. 1): More than twice as long as head; pedicel of segment III with slight angulation, segments III and IV each with v-shaped forked sense cones, 22–27 μ long; segment III distad of subapical setae slightly converging to apex, about $\frac{1}{4}$ length of segment, segment IV constricted into a neck in distal part; segment VI slightly pedicellate at base, inner sense cone 32–35 μ long, extending distally at least to apex of segment VII.

Head (Fig. 2): Slightly shorter than pronotum, about 1.5 times wider than long, cheeks rather straight, compound eyes almost twice as long as occiput; interocellar area without sculpturing, caudad of compound eyes with transverse striae, those more posterior spaced farther apart. Compound eyes each with 4 pigmented facets in 1–2,3,5 pattern (see Nakahara 1988). Diameter of fore ocellus 15–17 μ . Ocellar setae I short, about 12 μ long, just anterior of fore ocellus; ocellar setae II short, laterad of fore ocellus and just mesad of inner margin of compound eye, about 12 μ long; ocellar setae III well developed (Fig. 2a), between anterior part of posterior ocelli, separated by about diameter of fore ocellus, 45(37–48) μ long. Postocular (PO) setae 5 pairs; POi seta absent; POii seta 12–15 μ long, caudad of posterior ocellus; next laterad POiii seta 10–12 μ long; POiv seta longest (Fig. 2b), 32(24–33) μ long; POv and POvi setae laterad of and shorter than seta iv but longer than setae ii and iii. Mouthcone conical, longer than head, distal $\frac{2}{5}$ less convergent than basal $\frac{1}{5}$, extending to posterior margin of prosternum; mandible 124–136 μ long.

Pronotum (Fig. 3): Rectangular, broader

than long, sculptured with irregularly spaced transverse striae and sparsely anastomosing. Median discal area with 3–5 setae 10–12 μ long; 2 irregular rows of discal setae in posterior $\frac{1}{3}$, 7–9 setae in anterior row including a pair of longer submarginal setae (Fig. 3f), 20–24 μ , anterior of posteroangular setae; posterior row normally with 4 setae; anteromarginal setae 37–42(42–48) μ long (Fig. 3a), 2 short setae, 10–12 μ long, between anteromarginal setae; anteroangular setae 48(48–59) μ long (Fig. 3b); posteroangular seta inner pair 59(57–67) μ long (Fig. 3d), outer pair 57–59(59–64) μ long (Fig. 3c), about $\frac{1}{2}$ as long as notum; posteromarginal seta II 32(32–40) μ long (Fig. 3e). *Mesonotum*: Subtrapezoidal, anterior angulate area smooth with pair of campaniform sensilla, median and posterior parts transversely sculptured, laterally with striae oriented longitudinally; 2 pairs of short setae on or near posterior margin, inner pair 17–20 μ long, outer pair slightly stouter, 20–24 μ long. *Metanotum* (Fig. 4): Reticulated with most reticles longer than wide and oriented longitudinally, reticles in anterior medial area more polygonal and wider than other reticles; median setae 55–59(54–59) μ long, thicker than lateral setae 35–37(35–37) μ long; 2 campaniform sensilla in posterior $\frac{1}{3}$ of notum.

Forewing: Rather straight, apex pointed; fringe cilia wavy; costa with 20–24(19–20) cilia, 23–24(22–24) setae, setae at mid-length 40(37–42) μ long, shorter than width of forewing; forevein with 19–21(18–20) setae, hindvein with 16–17(14–15) setae; scale with 4 marginal and 1 discal setae.

Abdomen: Tergites sculptured anteriorly, and laterally of median setae and campaniform sensilla; median setae short, on VII 17–20 μ long; short ctenidia on tergite IV; posterior margins of intermediate tergites with series of low, truncate lobes, with a few small teeth laterally; tergite VIII with posteromarginal comb complete with 14(13–17) microtrichia, longest 17–20 μ long (Fig. 5); tergite IX with microtrichia on anastomosing striae, posterior pair of

campaniform sensilla near B1 setae (Fig. 6); tergite X subequal to IX, dorsal split almost complete on X. Ovipositor well developed, 183(222–235) μ long.

Measurements: Female holotype and (paratypes) in μ . Body length from anterior of eye 1176(1161–1221), distended 1423(1408–1568). Antenna: Total length 270(265–280); length and width of segment I 24(24), 27(27–30); II 37(35–37), 24(27); III 50(48–50), 22(22); IV 45(42–48), 20(20–21); V 37(37–40), 17(17(20); VI 52(52–54), 18(17–20); VII 10(10–11), 7(7); VIII 15(15), 5(5–6). Head length from anterior of compound eye 100(96–106), width at compound eyes 151(148–156), width at cheeks 156(143–158); length of compound eye 62(62–69), width 45; length of occiput posterior of compound eye 37(35–37). Pronotal length 124(126–133), width 190(178–190). Forewing length 729(679–729), width at midlength 57(52–57). Length of abdominal tergite IX 62(64–67), length of B1 setae 104–109(96–109) (Fig. 6a), B2 setae 101–106 (104–109) (Fig. 6b), B3 seta 100(100) (Fig. 6c); length of tergite X 64(64–67), length of B1 seta 109(96–111), B2 seta 98(94).

Male (macropterous).—Smaller than female, otherwise similar in color and most anatomical structures. Body length 1,000–1,050 μ . Antennal length 220–246 μ . Abdominal tergite VIII with complete postero-marginal comb with 13–14 long, slender microtrichia; sternites III–VII each with transverse glandular area with anterior and posterior margins concave, on III 52–62 μ wide, 15–17 μ long, on VII 40–54 μ wide, 12–15 μ long, 0.30–0.38 as wide as sternite; sternite VIII with posteromarginal microtrichia.

Type material.—Holotype ♀ and 18 ♀ and 2 ♂ paratypes: Brasil, São Paulo, Piracicaba, *Cucurbita pepo* L. cv. Caserta, 14-VII-95. R.C. Monteiro. Holotype and 10 paratypes deposited in Departamento de Entomologia, ESALQ, Universidade de São Paulo, Piracicaba, Brazil, 10 paratypes in the National Museum of Natural History,

Smithsonian Institution, Washington D.C. and 3 paratypes in The Natural History Museum, London, United Kingdom.

Etymology.—The species is named after the common name of the host, “zucchini,” and is a noun in apposition.

Distribution.—Known only from São Paulo State, Brazil.

Collected from.—*Cucurbita pepo* L. cv. Caserta (zucchini).

Comments.—*Frankliniella gemina* Bagnall and *F. rodeos* Moulton in Brazil are similar to *F. zucchini* in color and most anatomical characters. *Frankliniella zucchini* lacks POi seta and has ocellar setae III positioned between the anterior part of posterior ocelli and separated by about the width of the fore ocellus; whereas POi setae are present in the other two species and ocellar setae III are aligned with the anterior margin of posterior ocelli or slightly anterior and are farther apart.

Most *Frankliniella* species have three pairs of short postocular (PO) setae mesad or anteromesad of the fourth or longest pair of PO setae which is positioned posterior of the compound eye (Fig. 2). When only two pairs of short PO setae are present, the POi seta is normally absent. The normal position of POi seta is caudad of and usually slightly mesad of the inner margin of the posterior ocelli.

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LITERATURE CITED

- Nakahara, S. 1988. Preliminary study of facetal pigmentation in the compound eyes of *Terebrantia* (Thysanoptera). *Acta Phytopathologica et Entomologica Hungarica* 23(3-4): 321-329.
- Pozzer, L., R. O. Resende, M. I. Bezerra, T. Nagata, M. I. Lima, F. W. Kitajima, and A. C. De Ávila. 1996. Zucchini lethal chlorotic virus (ZLCV), a proposed new species in *Tospovirus* genus. *Fitopatologia Brasileira* 21 (Suplemento): 432.
- Rezende, J.A.M., S. R. Galleti, L. Pozzer, R. de O. Resende, A. C. De Ávila, and S. M. Scagliusi. 1997. Incidence, biological and serological characteristics of a tospovirus infecting experimental fields of zucchini in São Paulo State, Brazil. *Fitopatologia brasileira* 22: 92-95.
- Wijkamp, I., N. Almarza and D. Peters. 1995. Median latent period and transmission of tospoviruses vectored by thrips. pp. 153-156. *In* Parker, B. L., M. Skinner and T. Lewis, eds., *Thrips Biology and Mangement*. Plenum Press, New York and London.